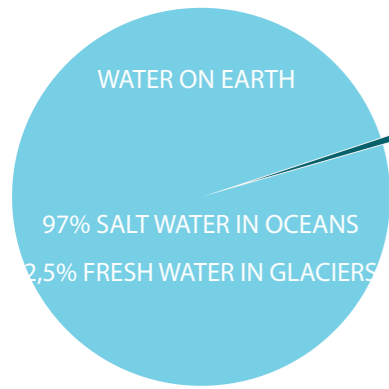
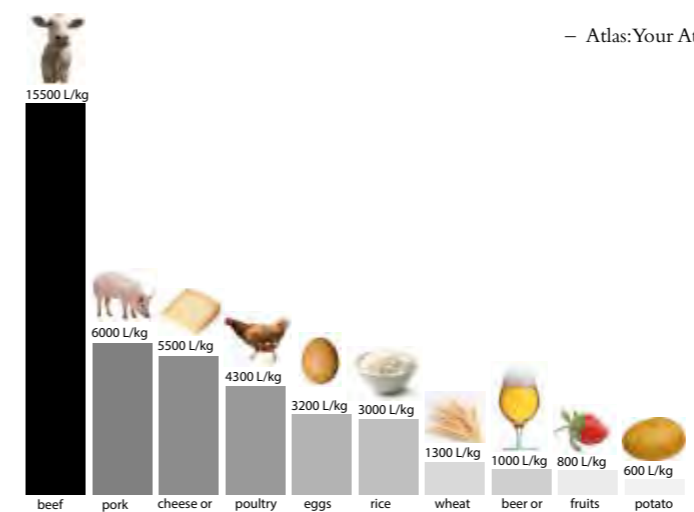


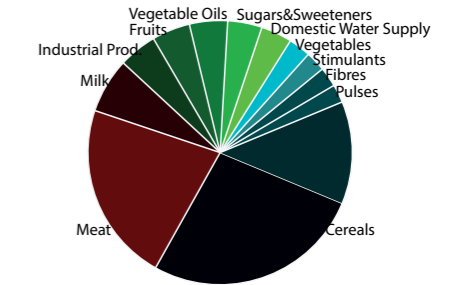
## WATER FOR FOOD WATER USE



- Amount of fresh water on earth is constant at about 12.500 m<sup>3</sup>.
  - We use only 1/3 of available fresh water supplies and yet there is water shortage in large areas on earth.
  - This is generally caused by unequal distribution of water, insufficient irrigation and mismatch between rainfall and where people live.
- Source: Atlas of Water

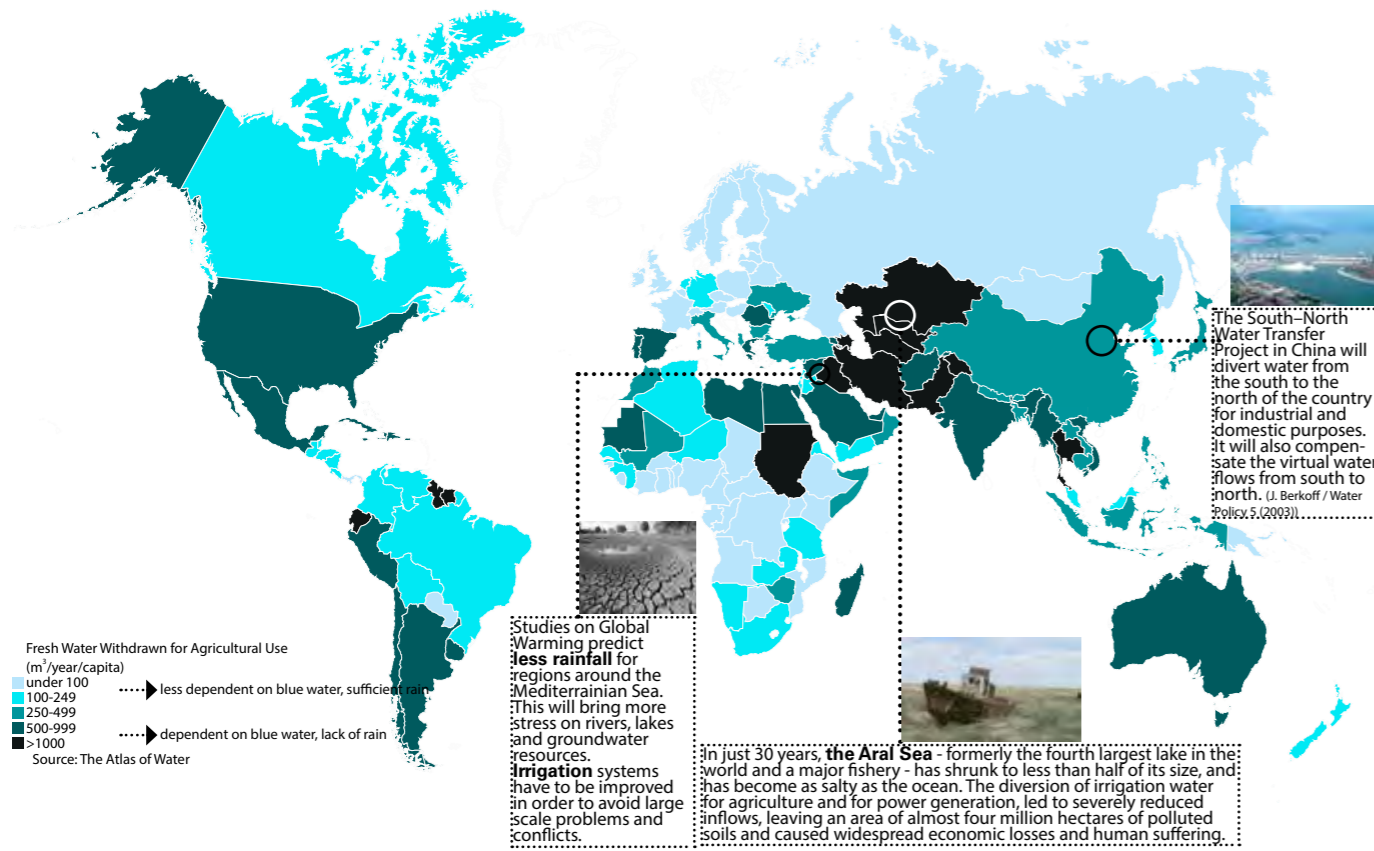


Water for Food: Average amount of water needed to produce 1 kg of food



Contribution of different product categories to the global water footprint.

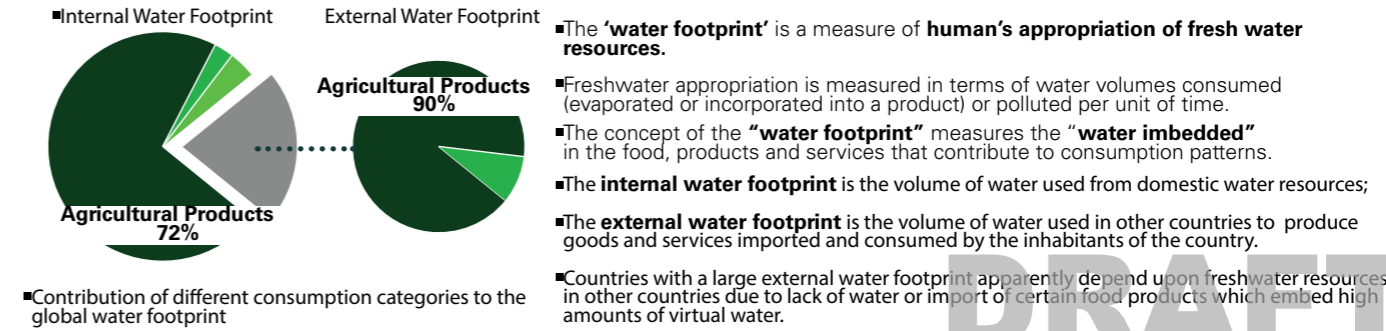
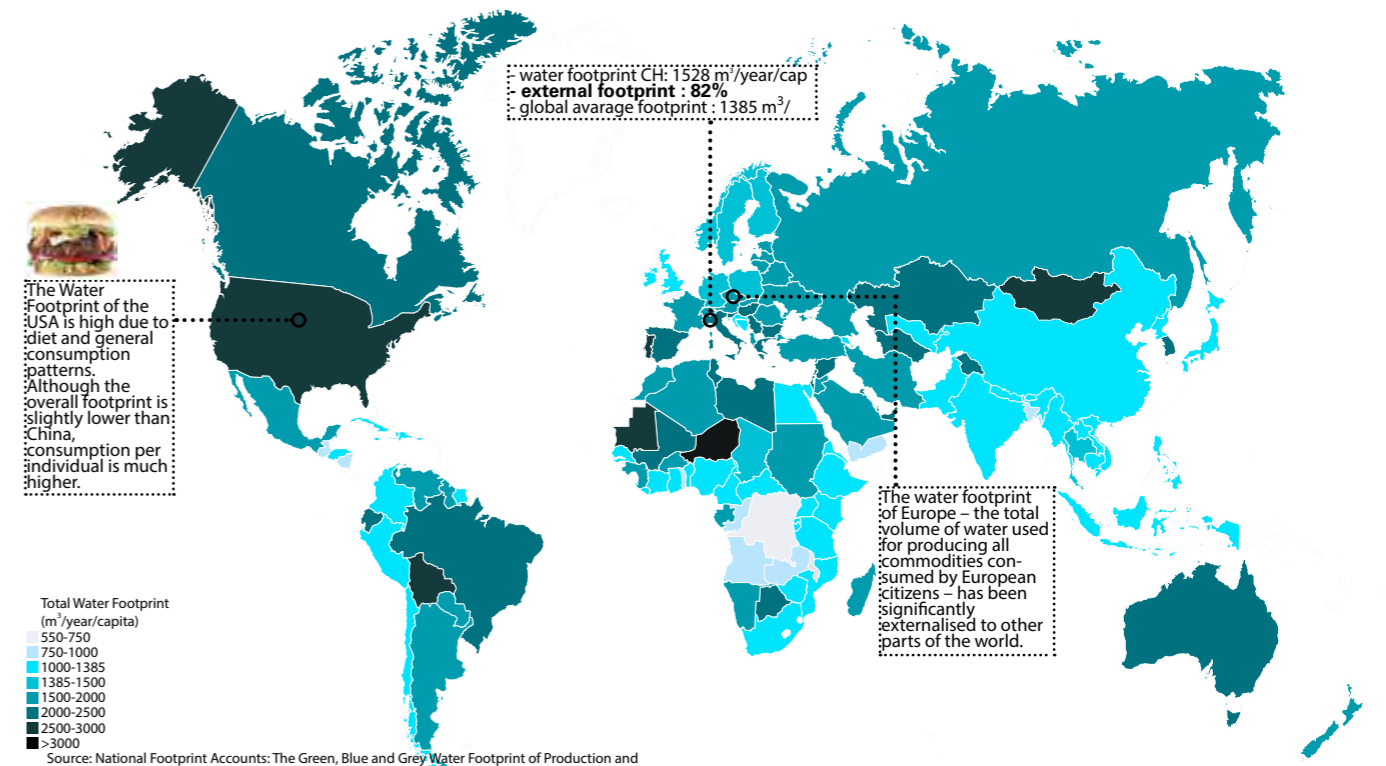
## WATER FOR AGRICULTURE



- All food production depends on water. Food crops flourish thanks to the rain or hydraulic manipulation.
- 1 calories = 1L of water. A human being with a decent 2000 calories diet requires approximately 2000L of water per day. This amount varies greatly between different individuals, countries or regions depending on food consumption patterns.
- Around 80% of agricultural water use is from rainfall stored in the soil, known as "green water", with the rest from "blue water" which comes from rivers, lakes, aquifers.
- Agriculture is responsible for 87 % of the total water used globally. In Asia it accounts for 86% of total annual water withdrawal, compared with 49% in North and Central America and 38% in Europe. It also has a big impact on the pollution in freshwater sources

Sources: 1. The Atlas of Water, Mapping the World's Most Critical Resource, M. Black, J. King  
2. Food & Water, A Question of Survival, Forum Engelberg/ 3. Unesco, National Water Footprint Accounts-Vol1-2, M.M. Mekonnen, A.Y. Hoekstra

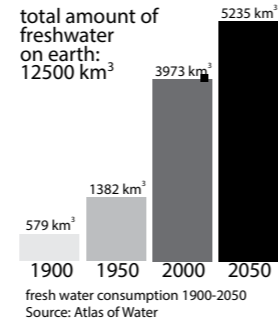
## WATER FOOTPRINT



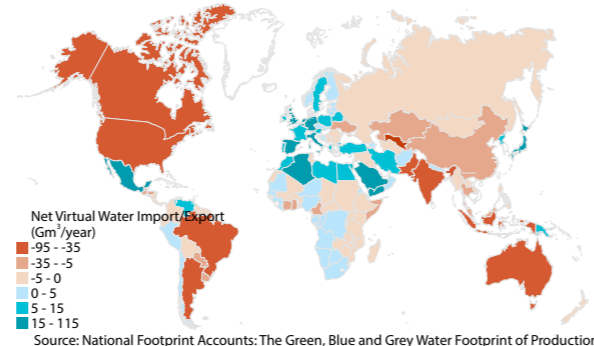
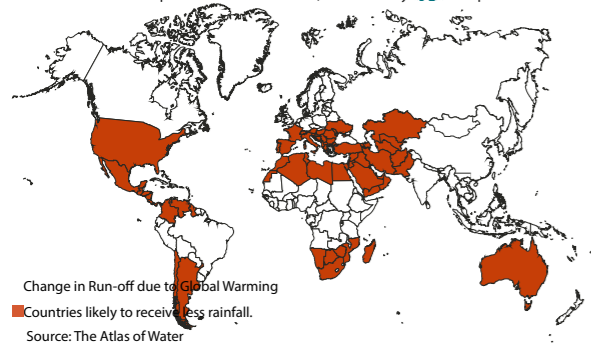
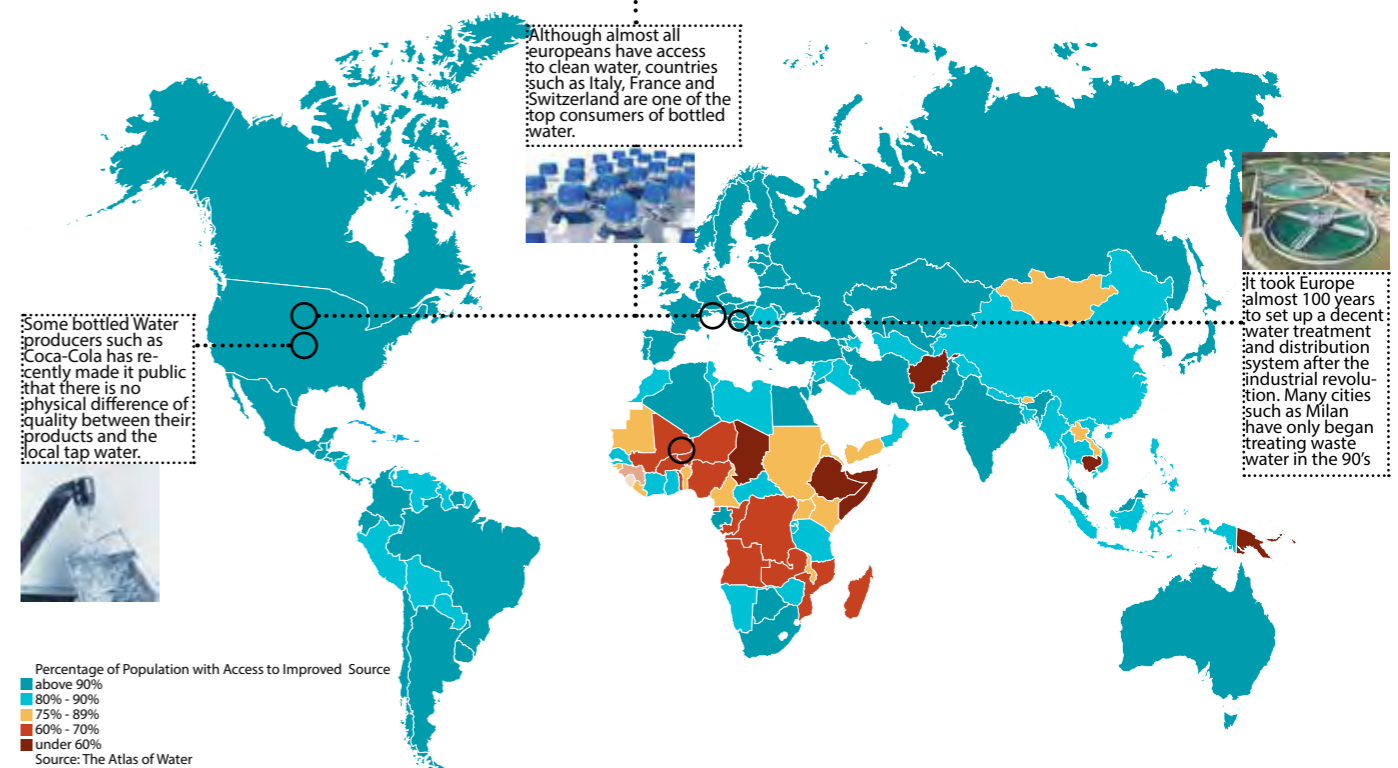
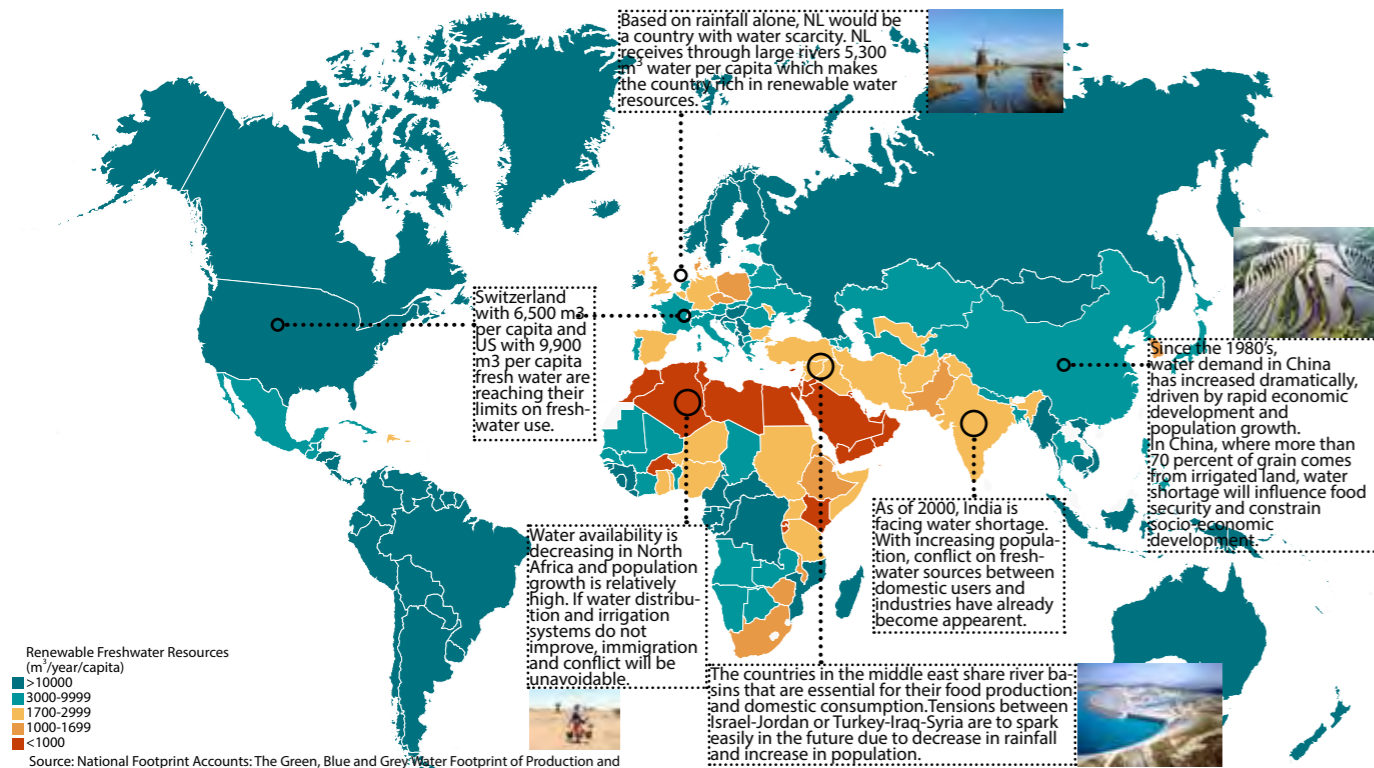
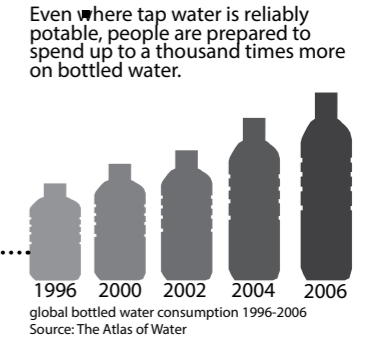
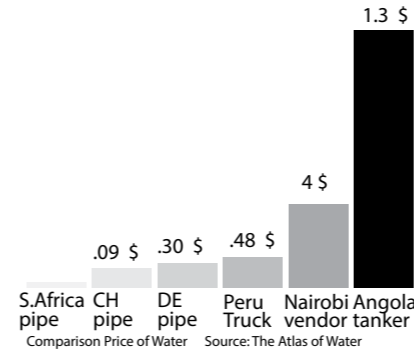
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## RENEWABLE WATER SOURCES

- The **water cycle** on Earth is essentially a **closed system** – we always have the same amount of water.
- **Renewable freshwater** ecosystems are the rivers, streams, lakes, ponds, groundwater, cave water, springs, floodplains, and wetlands (bogs, marshes, and swamps) that provide water for drinking, sanitation, agriculture, transport, electricity generation and recreation.
- Freshwater systems are habitat for diverse fauna and flora which provide an important source of food and fiber that sustain incomes and livelihoods, particularly for rural communities in developing countries (CBD2005; MA 2005a).
- Freshwater is the primary source of water for agriculture where there is not enough rainfall.
- International **Virtual Water** trade helps countries with insufficient renewable freshwater balance their water needs by importing certain agricultural products in which water is embedded.
- The high amount of virtual water import in European Countries increase their external footprint in countries such as Brazil and India.



## ACCESS TO DRINKING WATER



- **Improved Water Resources** are piped water to houses or yards, tube wells, public taps, protected dug wells and springs and rainwater collections whereas **Unimproved Water Resources** are unprotected wells or springs, water carts, surface water and tanker trucks.
- The term "improved" requires the water to be up to certain health standards, be close to home, potable and perennially reliable.
- Unimproved drinking water can spread disease, but using water for personal hygiene can prevent **disease transmission**.
- 3.575 million people die each year from water-related diseases.
- According to United Nations agencies, one-third of the world's population live in countries that are experiencing moderate to **high water stress**
- More than one billion people worldwide do not have access to **clean freshwater**. Three billion do not have adequate sanitation services and the annual death toll from water-borne diseases is estimated at more than three million. (wwf)

Sources: 1. The Atlas of Water, Mapping the World's Most Critical Resource, M. Black, J. King  
2. Food & Water, A Question of Survival, Forum Engelberg/ 3. Unesco, National Water Footprint Accounts-Vol1-2, M.M. Mekonnen, A.Y. Hoekstra

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### HISTORY OF WATER FOR FOOD



**EVENTS**

- 541-42 - **Plague of Justinian**
- 541-42 - **Plague of Justinian**
- The Arab Agricultural Revolution** between 650-1500 leads to new irrigation methods.
- 1347-1351 - **Black Death** in Europe claims around 50 million lives.
- 1850 - London: **The Great Stink** due to high amount of sewage and waste/USA:Fecal contamination of surface water causes severe health problems (typhoid, cholera) in some major North American cities, notably Chicago
- 1895- US/Mexico - **Harmon Doctrine**: US Attorney General Harmon rules that the US has no obligation to pay for damages caused in Mexico by river diversion.
- 1931 - **The Great Flood** in China claims between 2,5-4 million lives. The Yellow, Yangtze and Huai Rivers, which provide water for agriculture, causes extensive damage.
- 1940-70 **The Green Revolution** increased the demand for fresh water due to increased amount of food production and therefore irrigation.
- 2011 - **The worst drought** for the last 100 years hit Europe during Spring and Summer. Due to reduced precipitation, agricultural production was hit in England and central Europe.

**FACTS & FIGURES**

- AD 2th cent - **Rome** - The Population reaches 1million. Aqueducts provide the city with fresh water from distant clean water sources, avoiding epidemics.
- 19th century Industrialization. Chemicals—and not just microbials—now polluted the world's water supplies. Water Treatment becomes a bigger challenge.
- 1900 Fresh Water Extraction per capita: 350m<sup>3</sup>
- But by the end of the 1970s, nearly 80% of the people living in rural areas were still without an adequate water supply and more than that without adequate sanitation. (Water Policy 5 (2003) 91-99)
- As of 2006, **waterborne diseases** are estimated to have caused 1.8 million deaths each year. These deaths are attributable to inadequate public sanitation systems.
- 2000 Fresh Water Extraction per capita: 650m<sup>3</sup>
- 2002- 12,500 **desalination plants** around the world in 120 countries produces 1% of the total potable water consumed on earth.

**TECHNOLOGY**

- 3500 BC - **Irrigation** was being used in Mesopotamia, allowing year round Agriculture Sumerian Cities such as Ur,Uruk and Eridu appear with constant growth.
- The earliest evidence of urban sanitation was seen in Harappa, Mohenjo-daro/
- 1st cent. BC - Persia: **Qanat systems** allow usage of underground water in arid places, allowing growth and variety of cagricultural products.
- Tunnel of Eupalinos is the first underground aqueduct to serve the ancient Greek city of Samos
- 1st cent BC- **First Dams** by the Romans in Saint-Rémy-de-Provence built in order to supply water to nearby towns.
- 691 BC - **First aqueduct** (approx. 50 miles long) constructed to bring water to Nineveh.
- 312 BC - Rome: **Aqua Pippi** The first **Roman Aqueduct** is built.
- 607 - The Chinese begin constructing a massive **canal system** to connect the Yellow and Yangtze rivers
- 644 - Muslim inventors develop a windmill, used to pump water for irrigation water source.
- 800 - Arabic chemists produce **purified water**.
- 7th cent AD Egypt: The **Nilometer** in was one of the first devices measuring the water levels at a water
- 1126- France **The artesian well**, which provided water under pressure, so it did not have to be drawn up in buckets, was invented by monks in Artois, France.
- 12th cent- Netherlands Wind Mills are used to pump water out of areas below sea level in order to avoid flooding.
- 1780 - **The Perrier Brothers in Paris** were the first to erect a steam engine to pump water from the Seine River and sell it to individuals via pipe connection.
- Modern **Drip Irrigation** systems began its development in Afghanistan in 1886, later spreading the the US and Europe in 1920's, becoming the world's most valued innovation in Irrigation.
- 1940- The Construction of Irrigation Canals on the rivers feeding **the Aral Sea** in the Soviet Union leads to increased agricultural output (especially cotton) in the region.
- Researchers from both UCLA and the University of Florida successfully produced fresh water from sea-water in the mid-1950s
- The Aswan Dam** situated across the Nile River in Egypt was built between 1960-70. By providing reservoir storage, the undertaking had huge impact upon the agricultural production in the region.
- 2006 - **The Three Gorges Dam** in China is completed. The flooding of the area causes millions to be displaced but also provides energy and water to different industries.



### FACTS ON WATER

- A Household in Australia spends **282 L** of water per day whereas one in Ethiopia spends only **13 L**
- Lack of sanitation** is the world's biggest cause of infection
- Around 90% of **human waste** in the developing world is being discharged untreated into rivers.
- 1,5 billion** people on earth depend on Groundwater sources for their survival.

### FORECAST ON WATER

- By 2050 nearly **2 billion people** will be living on **water-short regions**
- Population in water-stressed river basins is likely to rise to **5 billion in 2050** from **1.5 billion in 1995**
- Urban Population will rise from **2.8 billion in 2000** to **4.2 billion in 2020**
- Number of people without decent toilets will decrease from **2.5 billion in 2008** to **2.4 billion in 2015**
- By the year 2025, **two-thirds of the world's population** could be facing serious problems with water availability.

Sources: 1. The Atlas of Water, Mapping the World's Most Critical Resource, M. Black, J. King  
 2. Food & Water, A Question of Survival, Forum Engelberg  
 3. Unesco, National Water Footprint Accounts-Vol1-2, M.M. Mekonnen, A.Y. Hoekstra/ 4. www.waterhistory.org/ 5. www.waterfootprint.org

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